# IFLA ASIA-PAC LA AWARDS 2023

## Award Categories:

**Built Projects-Parks and Open space**

## Project Title:

**Shachong and Miaochong river Design,**

**Mutualism of Water & Settlement:**

**Design of Resilient Floodway**

**Binhaiwan Bay Area, Dongguan, China**

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# Built Projects-Parks and Open Space

## Project Title:

Shachong and Miaochong river Design,
Mutualism of Water & Settlement: Design of Resilient Floodway
Binhaiwan Bay Area, Dongguan, China

## PROJECT STATEMENT

In 2020, Shachong and Miaochong river was designed, which was completed in 2023. The project is located at the top of Lingdingyang Bay and at the "Golden C" spot in the Guangdong Hong Kong Macao Greater Bay Area. The area is 68 hectares. In recent years, due to the rising sea level and the development of the city towards the coast, the urban flood control system urgently needs to be upgraded. The site is an important floodway in the flood control system that connects the urban water with the Lingdingyang bay.

The site is threatened by storm surges and floods, with the risk of riverbed exposure and soil erosion. This not only damages the healthy ecosystem of rivers, but also makes them an inaccessible space for humans.

Therefore, we believe that only use the principle of resilient landscape to integrate gray and green infrastructure can urban water relations be coordinated in the area. Through the strategic construction of resilient water management, resilient habitat, and resilient waterfront, we make cities coexist with water, adapts to nature, so that cities have the resilient to deal with interference. This is the way to realize the sustainable development of cities in future.

# PROJECT NARRATIVE

The project use the principle of resilient landscape design the floodway of Miaochong and Sha chong river. Compared with traditional engineering flood control, flood control based on resilient principle can make higher composite value, and it is a new approach to urban flood control in today. We are trying to transition the relationship between people and water here from "competing for land with water" to "urban water symbiosis" in this way.
Therefore, we put forward three design strategies: resilient water management, resilient habitat, and resilient waterfront to deal with the local flood and tide disaster, ecological degradation, and no active space.

## Resilient water management

The project focuses on flood control and safety assurance, it solves the flood and tide disasters in site. The design resilient revetment to carry more flood discharge capacity, and cascade revetment adapt to the erosion of riverbank water flow during flood and tide disasters.
Firstly, dredging and reshaping the river embankment shape using resilient revetment will be carried out to meet the new flood control standard of once every 100 years. Compared with traditional rigid vertical embankments, the resilient revetment method we adopt can increase flood discharge space by 30%, and this method can promote material exchange within the riverbed, thereby enhancing the ecological value of the river.
Furthermore, the use of cascade revetment to adapt to the impact of upstream floods and downstream tides on the revetment. In our the design, we adopted five graded revetment models to provide a diverse ecological base and diverse activity spaces for the site.
In the process of reshaping river channel morphology and cascade revetment, we have adopted some ecological engineering methods to stabilize the shoreline. One is to stabilize the revetment by combining pine pile fixation with soft foundation treatment. The second is to add a level of riprap revetment outside the revetment, which stabilizes the revetment while adding an elastic flood storage and detention area. These ecological engineering methods not only effectively resist floods and tidal impacts, but also enable sufficient material exchange between river water and riparian ecosystems. This set of resilient water management strategy not only meets the new level flood control requirements of the city, but also can improve the self purification capacity of the river.

## Resilient habitat

In order to improve the current ecological degradation problem, the design focuses on the construction of habitats based on the current mangrove wetlands.
First of all, rely on the ecological base of the river to create saline water wetland habitat, saline fresh water wetland habitat, evergreen forest habitat, mixed forest habitat and sparse forest grassland habitat, providing a health habitat for fish, birds, insects, etc.
Next, by repairing and creating the mangrove habitat with the largest proportion of the site, we will create a diverse habitat environment. Based on the on-site investigation of mangroves, strategies such as preservation, thinning, regeneration, and replanting will be implemented for different areas.
We have developed a mangrove habitat restoration toolbox, which provides a basis for the design, construction, and maintenance of mangrove restoration.

**In the design and construction of mangrove habitats:**
1. Select species based on the ecological habits of mangroves at suitable growth depths. The bottom beach is planted with Avicennia marina, the middle and low stalls are planted with Aegiceras corniculatum and Avicennia marina, and the high beach is planted with tree species such as Kandelia candel. At the intersection of the high beach and the land, the transition from shrubs to trees is made, and the bottom layer is planted with climbing vine like semi mangrove plants, such as Ipomoea pes-caprae, to improve biodiversity.
2. Properly preserve the floodplains and tidal channels. It provides space for animal, and the development of tidal creeks also has an important impact on mudflat ecological protection, geological heritage landscape, etc.
3. Artificially create micro terrain. Build sandbars, small islands, and ponds, use techniques such as riprap and pine pile cofferdams to transform the water banks, increase the space for fish and shrimp activities, and increase biodiversity.

**In the later maintenance of mangrove habitats:**
1. Trench excavation and beach filling: use strip filling and excavation mode to raise the level of beach surface to cope with the problem of lifting mudflat.
2. Trenching for water diversion can be carried out when the sedimentary water surface cannot reach the tidal flat, and water can be diverted into the mangrove forest.
3. Improve sandy soil, and enhance soil fertility.

## Resilient waterfront space

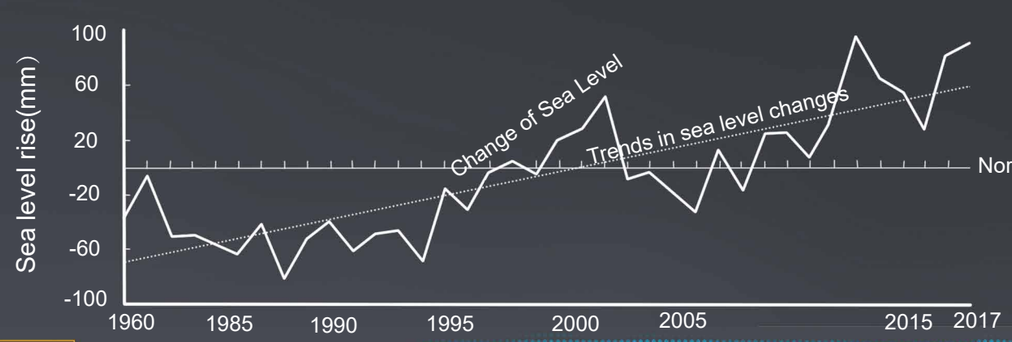
Based on the issue of human and water isolation in site, we utilize the space generated by resilient flood storage and detention areas and habitats to provide leisure activities for urban residents. The design aims to release waterfront space in nature and design rich waterfront activities, introducing education, sports, and social interaction into nature, creating a pleasant waterfront environment. The project focuses on three types of activity venues: education in nature, sports in nature, and social interaction in nature, allowing activity spaces that involve education and entertainment, natural oxygen supply and rest spaces, and dialogue spaces that embrace nature to run through the riverbank.
After the completion of the project, greater ecological and social benefits were generated. First, it ensure water security and local economic development. After the completion of the project, the flood control and drainage capabilities of MiaoChong and ShaChong river have been improved, and the flood discharge capacity has increased by 7m³/s. And achieve the standard of flood control once every 100 years, effectively resist flood and tide disasters. It promote sustainable social and economic development in the region.
Secondly, the project has attracted more birds. According to data from the China Bird Watching Center, 35 bird species were observed in the local project site and its vicinity before the project construction. After the project was completed, the number of bird species observed in the project site and its vicinity increased to 124, four times the original number.

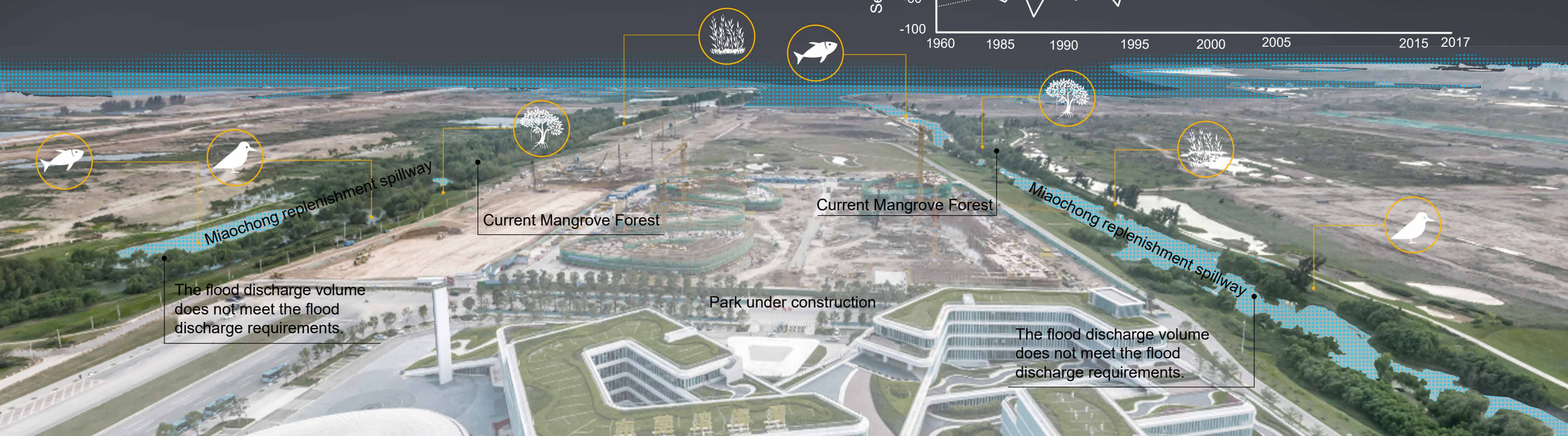
# Background

The site is an important link in the upgrading of the urban flood control system due to the rise of sea level and the development of the city towards the coast. It is an important flood passage connecting the urban flood control system with the seawater in Lingdingyang.

Due to recent sea level rise and the development background of coastal areas, combined with human factors and natural environment, the frequency and destructive power of upstream floods and downstream storm surges on the site have become increasingly high, resulting in greater losses from flood and tide disasters. The situation of flood and tide disasters is becoming increasingly severe. The project is part of the flood control project and aims to minimize the impact of floods and tidal disasters on the area. In addition, the project also undertakes the function of ecological replenishment of urban water systems.

The project is located in Binhai Bay New Area, Dongguan City. The new area is located in the "Golden C" of Guangdong Hong Kong Macao Bay Area, the east bank of the Pearl River Estuary, and the top of Lingding Bay. The project is located in Chang'an Town Industrial Zone to the north, Jiaoyi Bay Core Area to the south, Shajiao Metropolitan Area to the west, and Shenzhen Airport to the east. The planned design area is 68ha. The project aims to prevent floods (tides), improve the water environment, and enhance the water landscape. By expanding the flood discharge section, we can meet the flood control and ecological water replenishment needs of Chang'an Town, and improve the ecological environment of Chang'an Town; By constructing a new waterfront landscape belt, we aim to enhance the water landscape of Binhai Bay New Area, laying favorable conditions and safety support for the construction of an international Binhai New City that is suitable for entrepreneurship, residence, logistics, sales, tourism, and landscape.

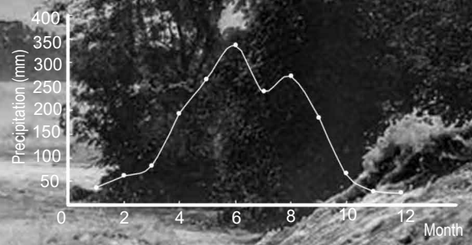



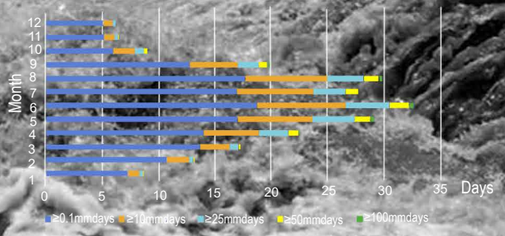
# Challenge

## FLOOD AND TIDAL DISASTER

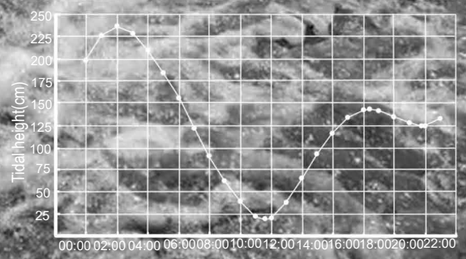
Annual average precipitation

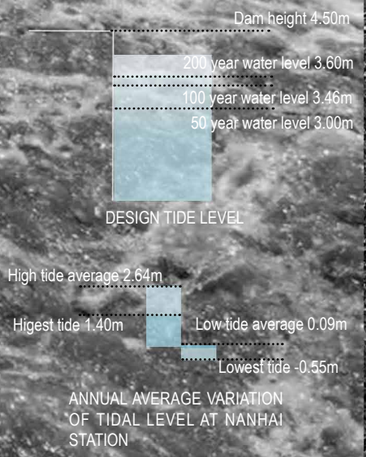



Average number of precipitation days at each level per month




Tidal elevation at Nansha (Shuiniutou) Station on November 21, 2020



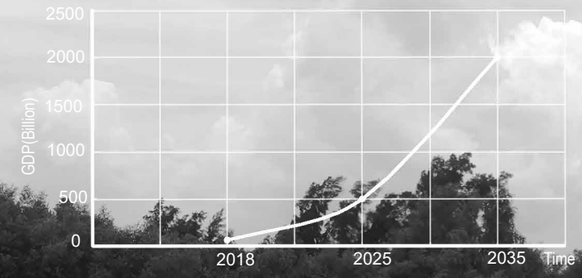

## ECOLOGICAL DEGRADATION

Inferior Class V water

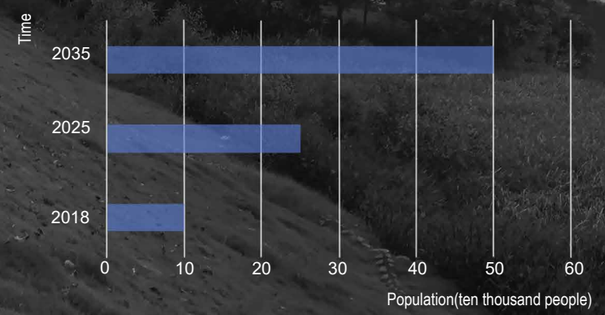
The mangroves have been cut down

## NO ACTIVITY SPACE

GDP objective




Population objective




## Flood and tidal disaster

The site is affected by flood and tide disasters, with the upper part being threatened by floods in the basin and the lower part being attacked by storm surges. Flood and tide disasters are frequent. The site is not only faced with short-term rainstorm, but also the threat of instantaneous high water level.

## Ecological degradation

The site is facing ecological degradation. The mangroves have been cut down. And the water quality of the waterway is Class V water, which does not meet the requirements of Class III external seawater quality that is connected to it.

## No activity space

Lack of venue activities, water and shore stripping. According to the overall urban planning of Binhai New Area, by 2035, the planned permanent population is 500000 and the employed population is 700000, making it an important city. The area needs to be forward-looking in carrying future population activities.

# Vision——Mutualism of Water & Settlement: Design of Resilient Floodway

## Reflecting urban and water accrete, designing of floodway based on the principle of resilient landscape.

Integrate gray green infrastructure using the principle of elastic landscape, transforming the relationship between people and water from "competing for land with water" to "symbiosis between urban water".

Shachong river

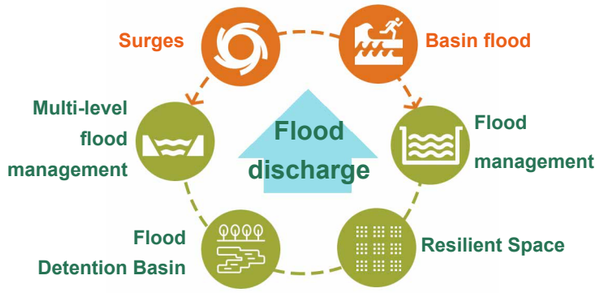
Compared with traditional engineering flood control, flood control based on the concept of elastic cities can generate higher composite value and is a new approach to urban flood control today. By coordinating the relationship between man and nature, so that the defense system can learn to adapt to nature, the city can have more flexibility to deal with various external interference, which is also an important way to achieve the sustainable development of the city in the future.

Miaochong river

# Masterplan and strategy

Based on the principle of resilient landscape, integrating grey green infrastructure, the overall design is carried out through three major design strategies: resilient water management, resilient habitat, and resilient waterfront, so that urban water can accrete.

## Flood and tidal disaster



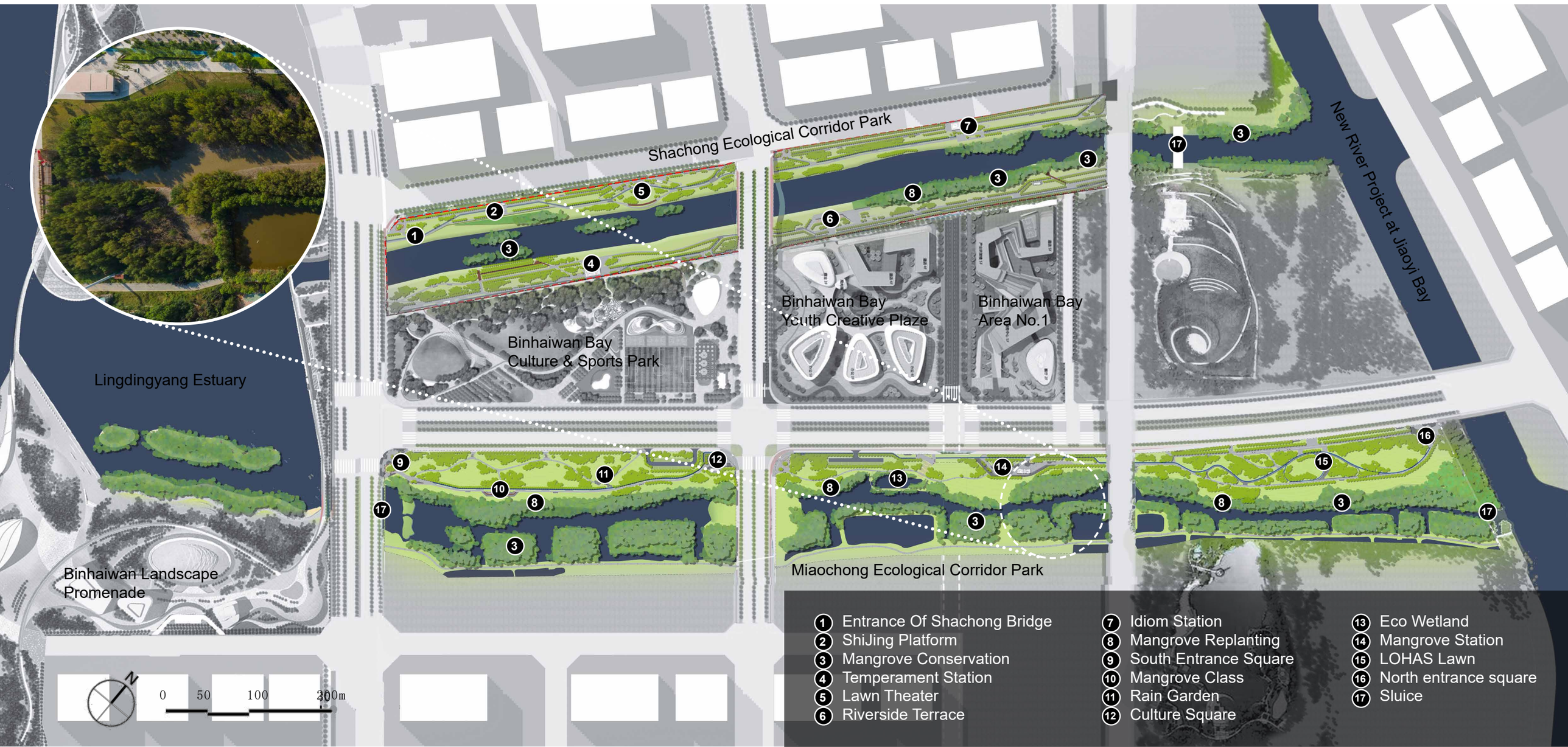

## Ecological degradation


## No activity space


## Resilient water management

## Resilient habitat

## Resilient waterfront

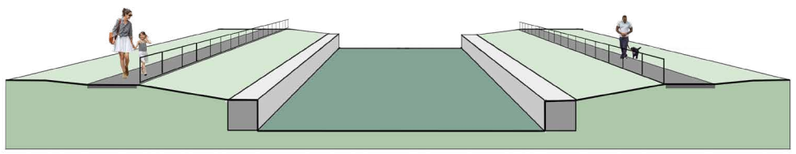


# Strategy 1 Resilient water management

## Flood Safety Control

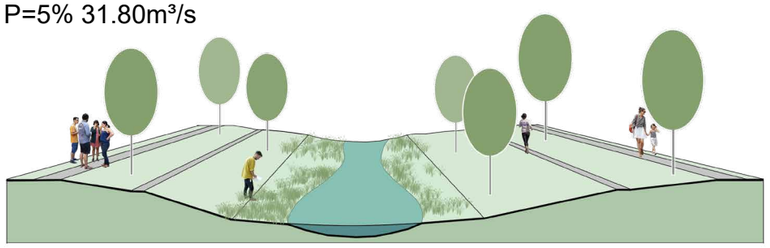
### Pattern Diagram

BERFORE
P=2% 31.55m³/s
P=5% 24.80m³/s



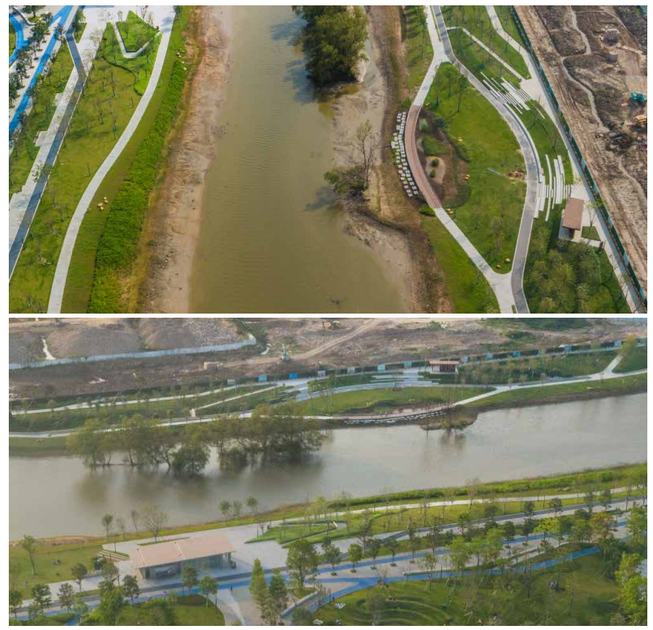
AFTER
P=2% 31.80m³/s
P=5% 31.80m³/s

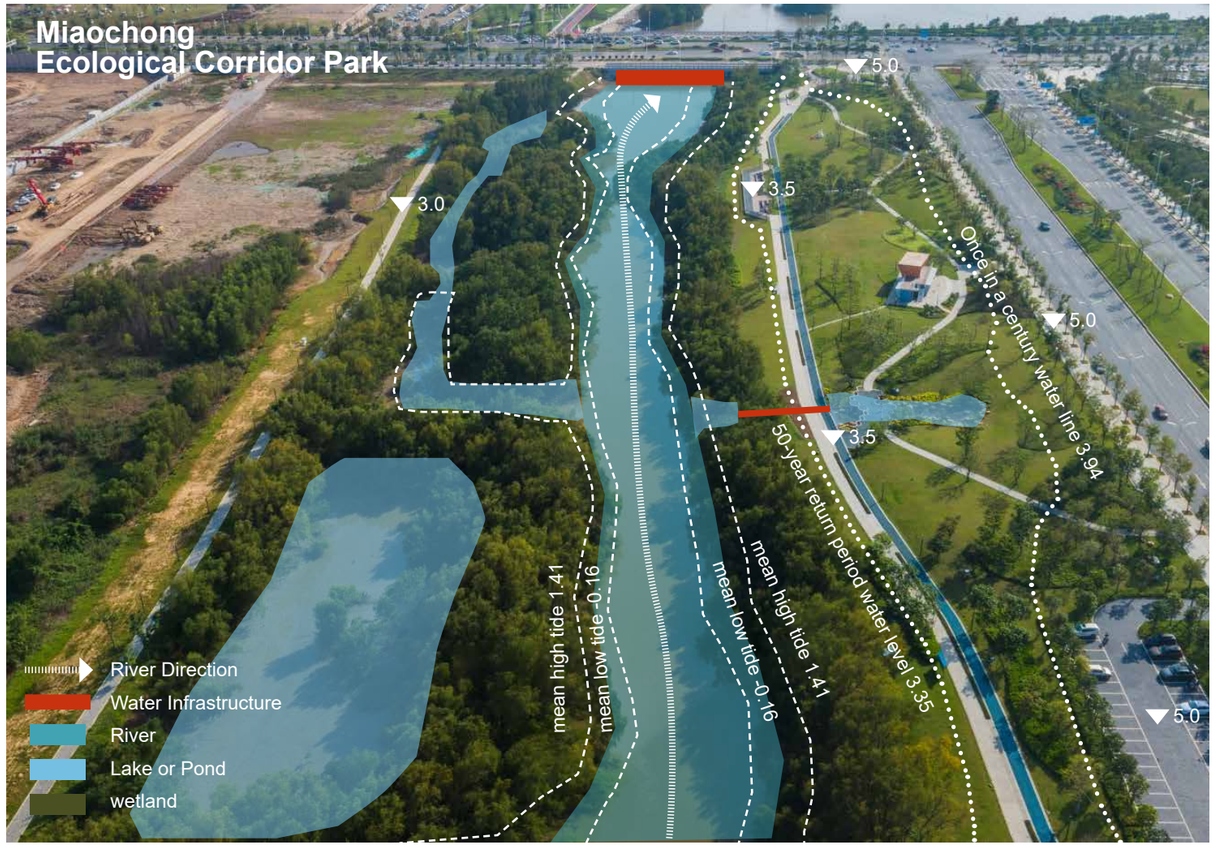
**P=2% +0.25m³/s**
**P=5% +7.00m³/s**

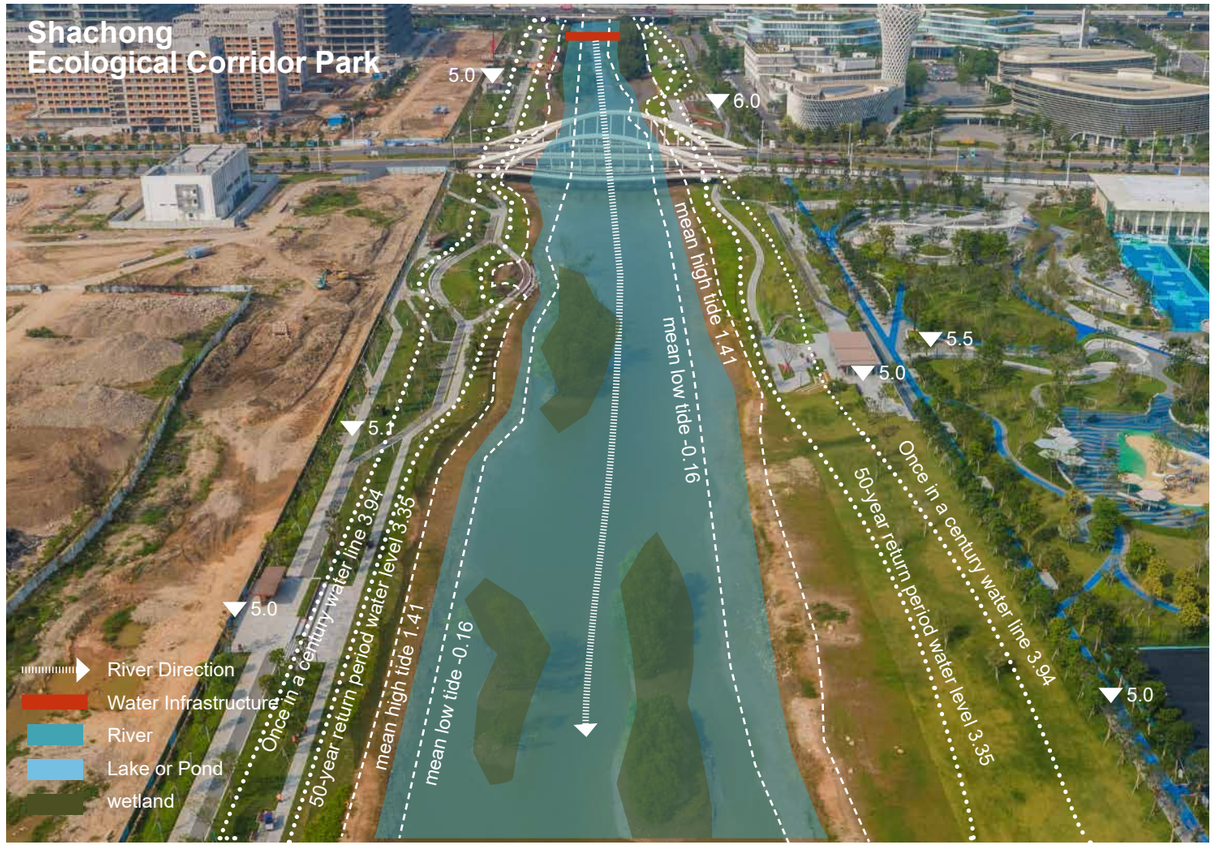


**Step 1:** Dredging——**Step 2:** Widen The River——**Step 3:** Revetment Foot Guards——**Step 4:** Slope Protection——**Step 5:** Landscape Construction

**Normal-water level and flood level contradistinction**



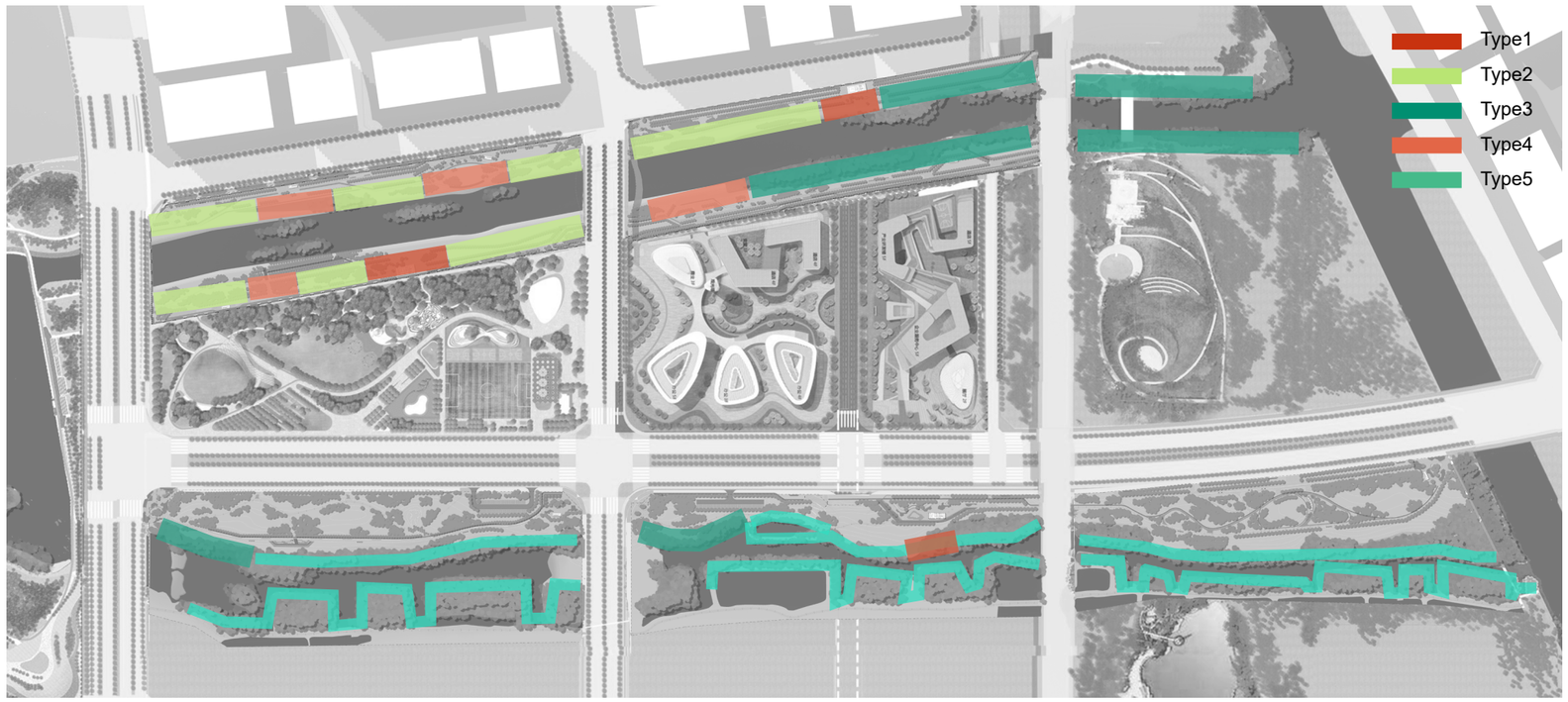


# Strategy 1 Resilient water management

## Bank Protection Strategy

### Type distribution plan




### River bank subarea and bank protection strategy guideline

**Bank top level**

100years flooding level 3.94

**Bank protection area**

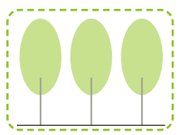
mean high tide 1.41

**Water level changing area**

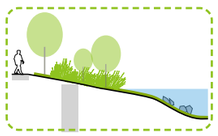
**Planting strategy**

Local planting of large trees and shrubs is based on the principle of not affecting flood fighting and emergency rescue.

**Planting strategy** | **Bank protection strategy**



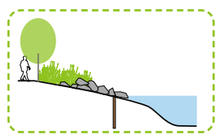
Large trees and shrubs ca-n be planted sporadically, on the principle of nothind-ering flood discharge.



**Grid mixing pile + slope**

Gentle slopes are adopted to create a water-friendly landscape.Ground treatment adopts grid type mixing pile.

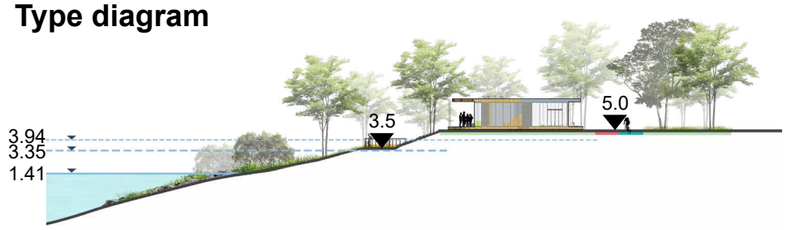
**Bank protection strategy**



**Pine stake + riprap**

Pine stake are used to prevent silt disturbance and protect the native mangroves; riprap foot protection is used on the water side.

### Type diagram

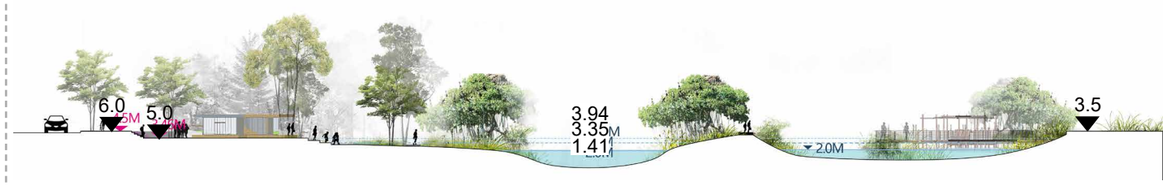



Type 1 Resilient flood channel & Building


Type 2 Resilient flood channel & Running track


Type 3 Resilient flood channel & Popular science landscape


Type 4 Resilient flood channel & Plaza




Type 5 Resilient flood channel & Mangrove forest

# Strategy 1 Resilient water management

## Bank Protection Strategy

# Strategy 1 Resilient water management

## Bank Protection Strategy

**Riprap Treatment**

1 Shoreline foot protection with pine piles, cast stone and aquatic plant rolls

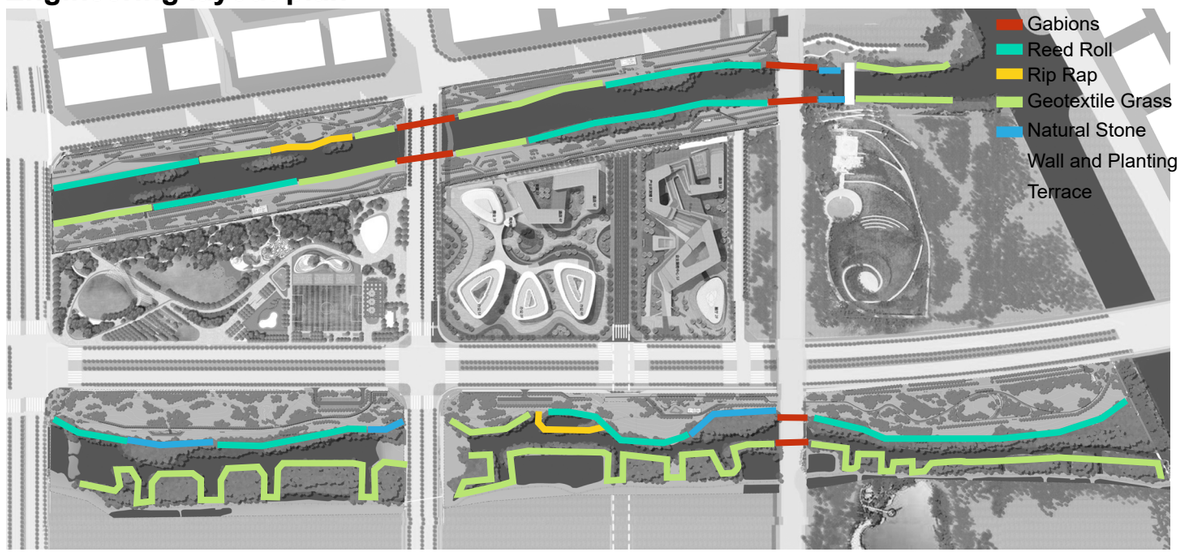
2 Pave with permeable materials to relieve rain and flood pressure

3 The grass slope is treated with vacuum preloading, and shape the micro-topography to increase surface runoff

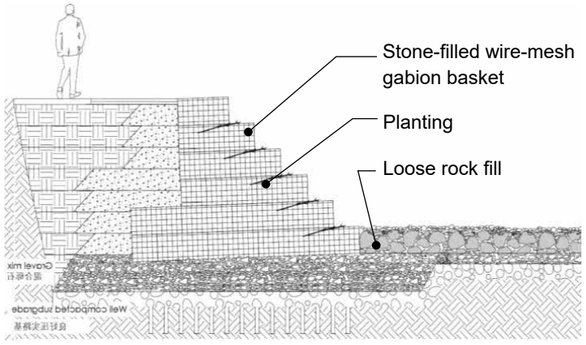
# Strategy 1 Resilient water management

## Ecological Revetment Method

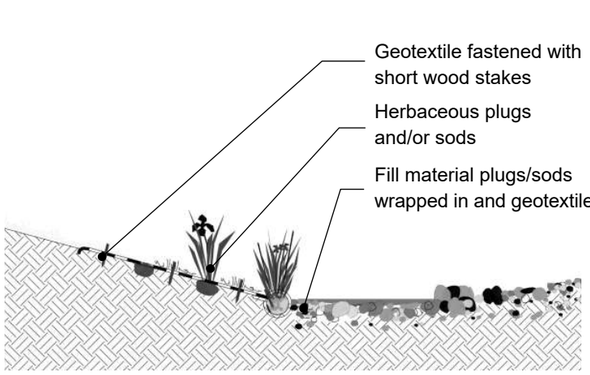
### Engineering layout plan



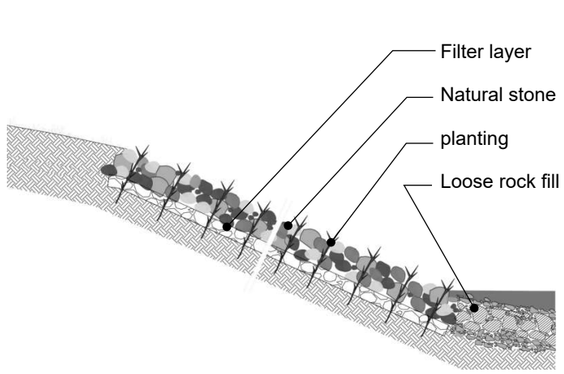

### Gabions



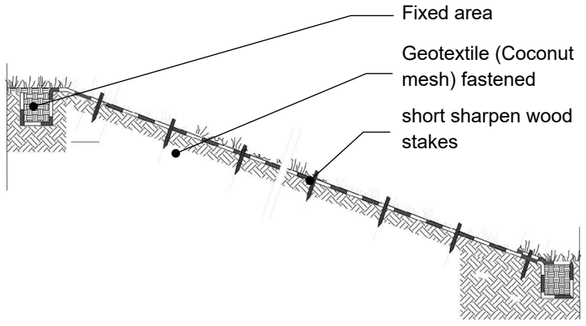

### Reed Roll

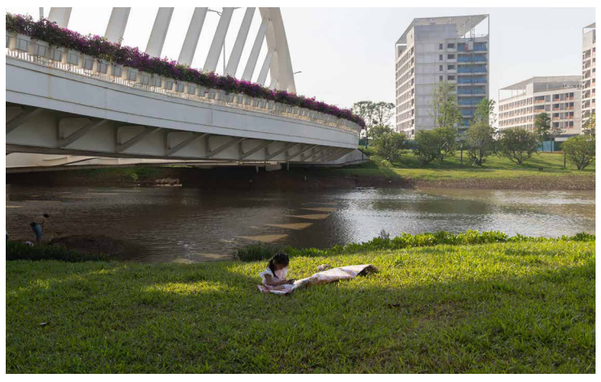



### Rip Rap

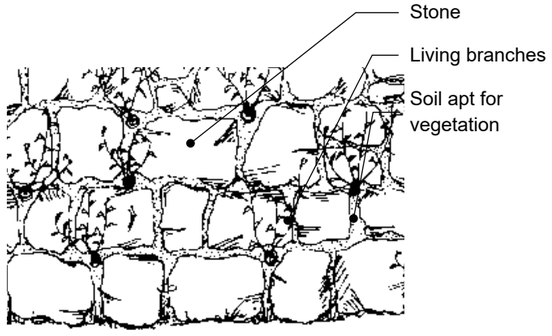



### Geotextile Grass



### Natural Stone Wall and Planting Terrace




# Strategy 2 Resilient habitat

## Habitat construction

**Sparse forest habitat**


Migratory birds


Resident bird

**Mangrove habitats**


Native mangroves


Benthic species

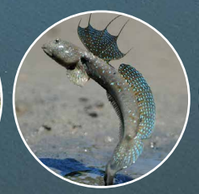

Migratory birds


Resident bird

- Mangrove habitat
- Hygrophytes habitat
- Jungle habitat
- Sparse forest habitat
- Grassland shrub habitat
- Tidal habitat

**Hygrophytes habitat**


Saline tolerant plants


Benthic species


Migratory birds

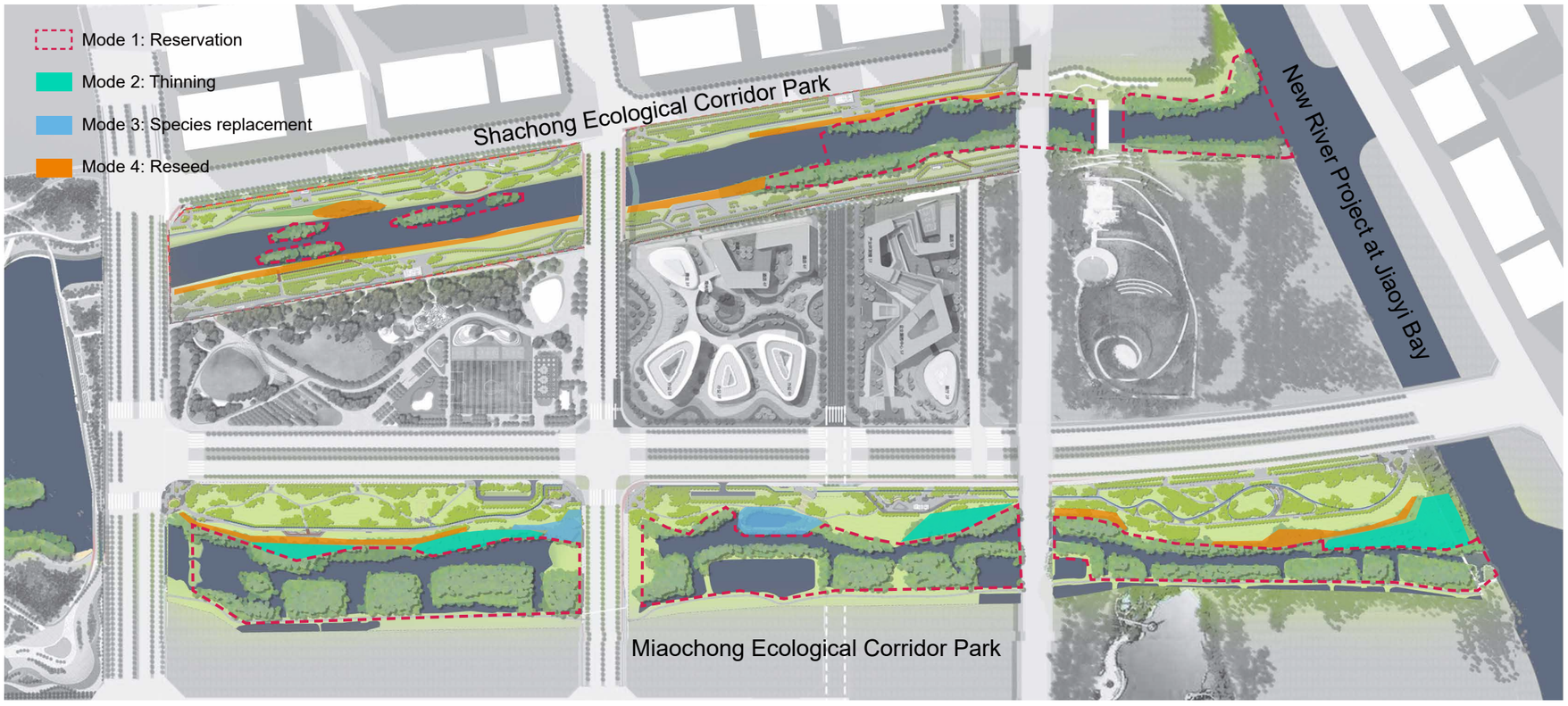

Resident bird

**Shachong Ecological Corridor Park**

**Miaochong Ecological Corridor Park**

# Strategy 2 Resilient habitat

## Restoration and creation of mangrove habitat




### Mangrove Restoration Tree Species List

| Species | Suitable area | Suitable tide level | Suitable salinity |
|---|---|---|---|
| *Kandelia obovata* | Coastal areas of the province | mid;high | low;mid;high |
| *Aegiceras comiailatiim* (L.) Blanco | Coastal areas of the province | low;mid;high | low;mid; |
| *Avic&itiia marina* (Forsk) Viefh. | Coastal areas of the province | low;mid; | mid;high |
| *Rhizophora stylosa* Griff | Coastal areas of the province | low;mid; | mid;high |
| *Bnigiiiera gymnorhiza* (L.) Savigny | Coastal areas of the province | mid;high | low;mid; |
| *Lumnitzera racemosa* Uilld. | Coastal areas of the province | low;mid;high | low;mid;high |
| *Ceriops tagal* (perr.) C. B. Rob. | Coastal areas of the province | high | mid;high |
| *Acanthus ilicijblhis* L. Sp. | Coastal areas of the province | low;mid; | low;mid; |
| *Acrostichum aureuin* L. | Coastal areas of the province | low;mid;high | low;mid; |
| *Excoecaric agallocha* L. | Coastal areas of the province | high;lake zone | low;mid;high |
| *Heritiera liticralis* Drpnd. | Coastal areas of the province | high;lake zone | low;mid; |
| *Pongamiapinnata* (L.) Pierre | Coastal areas of the province | lake zone | low;mid; |
| *Thespesia populnea* (L.) Soland. ex Coir. | Coastal areas of the province | lake zone | low;mid; |
| *Barringtonia racemosa* (L.) Spreng | Coastal areas of the province | lake zone | low |
| *Cerbera manghas* | Coastal areas of the province | lake zone | low;mid; |
| *Hibiscus tiliaceiis* L. | Coastal areas of the province | high;supratidal zone | low;mid;high |
| *Clerodendnnn inerme* (L.) Gaertn. | Coastal areas of the province | high;supratidal zone | low;mid;high |

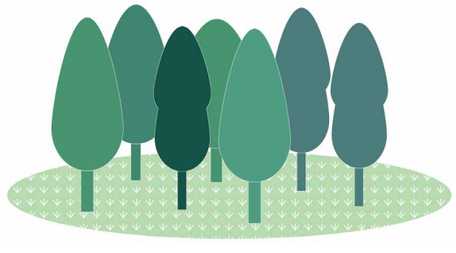
Classification of salinity: low salinity when the annual average seawater salinity is less than 15‰; medium salinity when the average annual seawater salinity is between 15‰and 25‰; high salinity when the annual average seawater salinity is higher than 25‰ salinity.

### Mode 1: Reservation

Implementation of mangrove community conservation strategies in areas with good mangrove habitat

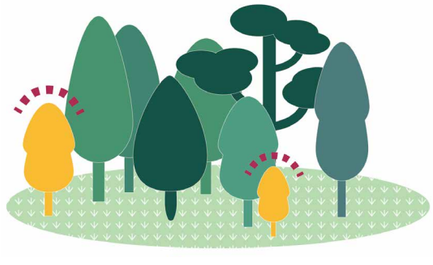
### Mode 2: Thinning

Thinning the community of a single mangrove tree species, and replanting some suitable semi-mangrove and mangrove species to increase species diversity and community stability



### Mode 3: Species replacement

Renew the communities with pests and diseases and poor growth to maintain the healthy development of mangrove communities.



### Mode 4: Reseed

Replant mangroves in areas with needs and potential to build new mangrove communities.

# Strategy 2 Resilient habitat

## Mangrove community construction

### Mangroves

Avic&itiia marina (Forsk) Viefh

Kandelia obovata

Aegiceras comiailatiim (L.) Blanco

Acrostichum aureuin L.

### Semi-mangrove plants

Heritiera liticralis Drpnd

Hibiscus tiliaceiis L.

Barringtonia racemosa (L.) Spreng

1 Selection of mangrove species for replanting according to water depth and transition to semi-mangrove plants at the interface with land

2 Appropriate retention of light banks and tidal ditches to provide space for animal habitats

### Regional iconic species

Platalea minor

Limosa limosa

Calidris canutus

Egretta garzetta

Pycnonotus sinensis

Tringa brevipes

Uca arcuata

Scartelaos histophorus

# Strategy 2 Resilient habitat

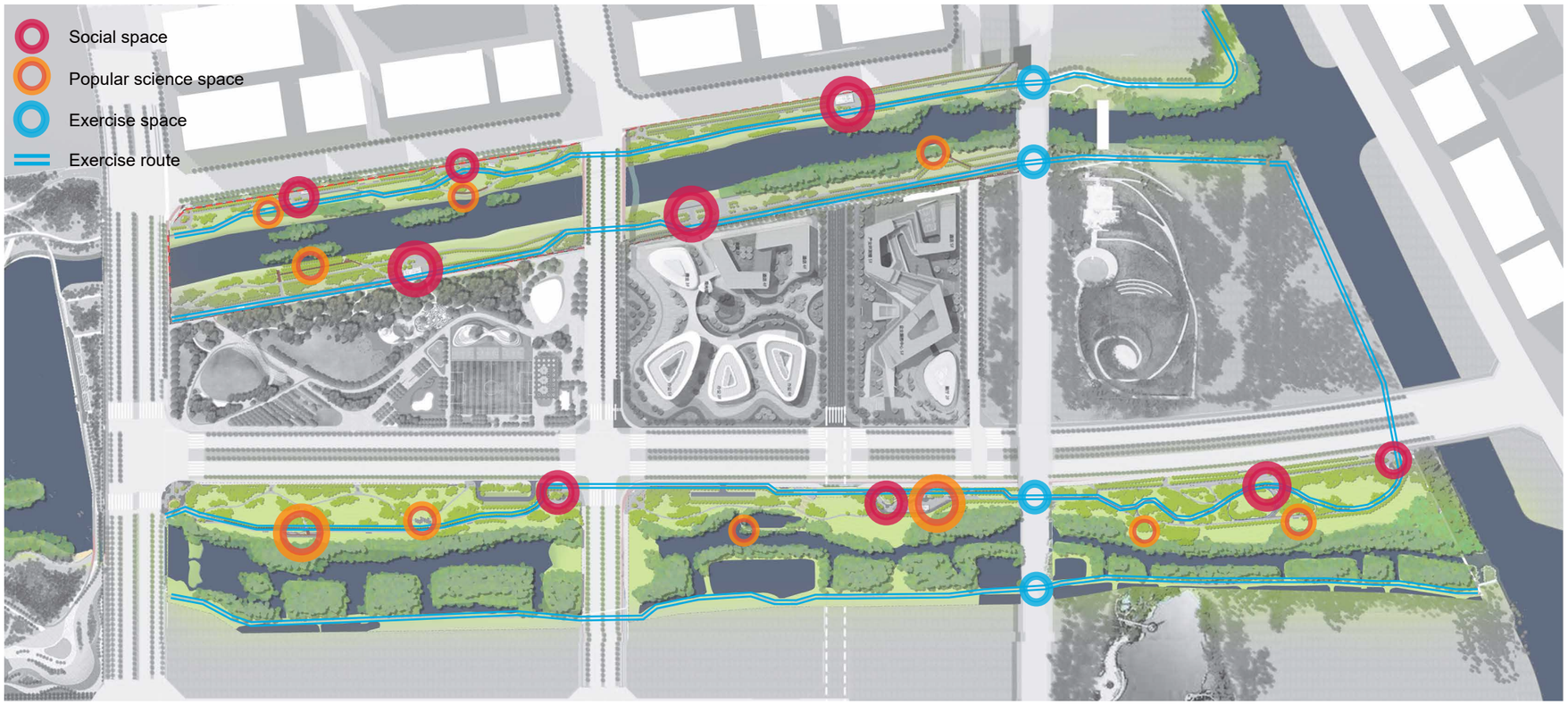
## Mangrove Restoration and Protection Project

1 Ditching and beach filling to create microtopography. The construction of sandbar islets and reservoirs and the use of rock throwing and pine pile weirs to transform the waterfront, increase the space for fish and shrimps and increase biodiversity.

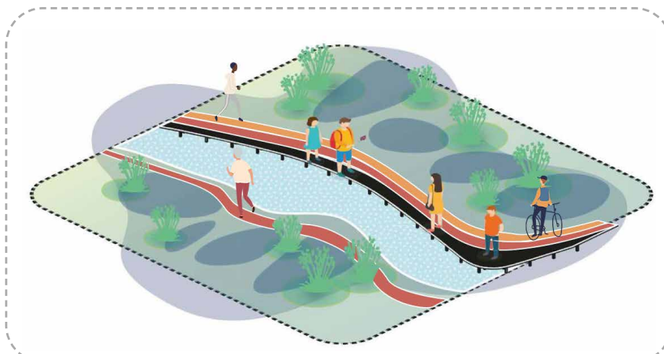
2 Improving the soil and enhancing the fertility of the shield.

# Strategy 3 Resilient waterfront

## Safety Activity Space







Scene 1:Exercise in nature

Running Fitness Stroll Riding

Scene 2: Education in nature

Science cognition Birdwatching Tide-watching Flora & Fauna Awareness

Scene 1: Socialize in nature

Camping Communication Recreation

# Strategy 3 Resilient waterfront

## Education in nature

The site provides an opportunity for children's nature education and the relationship between man and water is reconnected.

# Strategy 3 Resilient waterfront

## Education in nature

Popular Science of Mangrove Habitat Birds

bird watching enthusiast

Mangrove Science Popularization

Providing a glimpse of nature

Taking a closer look

# Strategy 3 Resilient waterfront

## Exercise in nature

On the edge of the restored mangrove forest, winding trails weave through nature and allow for lightly intervening movement, fully reflecting the restraint of the design.

# Strategy 3 Resilient waterfront

## Exercise in nature

The waterfront walkway is a daily recreation area for nearby residents

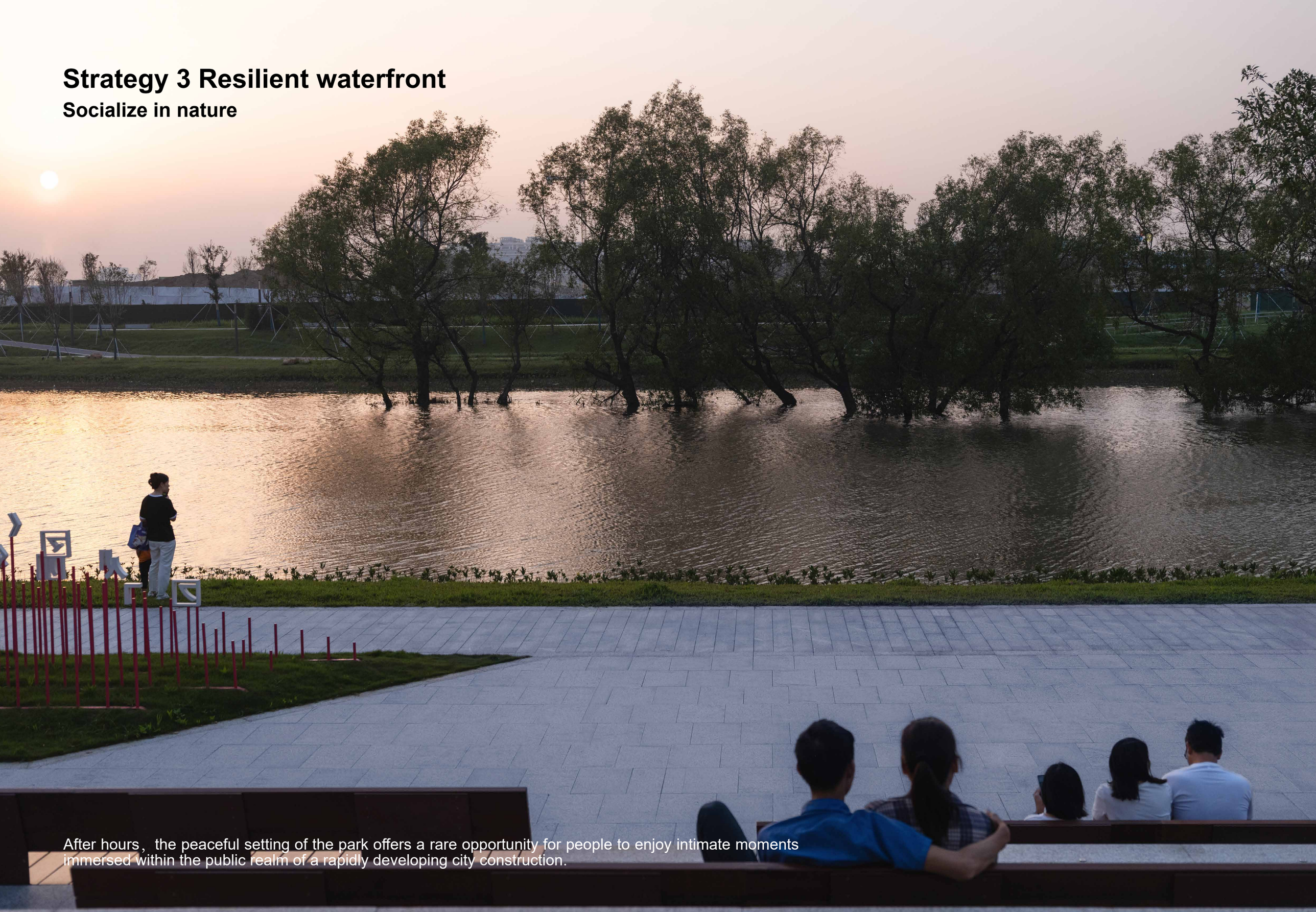
Under-bridge sports ground

Cycling paths in nature

Floodable riprap trail

# Strategy 3 Resilient waterfront

## Socialize in nature



After hours，the peaceful setting of the park offers a rare opportunity for people to enjoy intimate moments immersed within the public realm of a rapidly developing city construction.

# Strategy 3 Resilient waterfront

## Socialize in nature

Water-friendly Sitting Plaza

Resting platform by the mangroves

A quiet corner by the mangroves

Family camping

Outdoor photography

Chat space under the bridge

# Ecological implemention Benefit

## The project has attracted more birds

According to data from the China Bird Watching Center, 35 bird species were observed in the local project site and its vicinity before the project construction. After the project was completed, the number of bird species observed in the project site and its vicinity increased to 124, a fourfold increase. It includes egrets, egrets, Common Greenshank, night herons, pond herons, etc.

## The project effectively purified the water quality

Within a year, the water quality of the elastic river channel has changed from poor Class V water to Class V water, and the purification function of the river channel has been demonstrated.

## The project has protected and restored over 30 hectares of mangrove forests

The mangrove habitat has increased from 10 hectares to 30 hectares, providing a habitat for more organisms and playing an important role in the quality of urban ecological environment.

# Social implemention Benefit

## The project ensures water safety and local economic development

After the completion of the project, the flood control and drainage capabilities of Miao Chung and Sha Chung have been improved, and the flood discharge capacity has increased by 7m ³/s. And achieve the standard of flood control (tide) once every 100 years, effectively resist flood (tide) disasters, and promote sustainable social and economic development in the region.

## The project has saved the cost of frequently repairing embankments

The project has undergone resilient revetment renovation and hydrodynamic shaping of the embankment, effectively preventing water and soil erosion caused by water flow erosion, and saving on the annual cost of embankment restoration.

## The project has raised the environmental awareness of the local public

The project relies on mangroves to carry out nature education, with 12 nature education activities held annually.